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Report to the Chairman, Subcommittee on
Federal Services, Post Office, and Civil
Service, Committee on Governmental
Affairs, U.S. Senate

March 1992

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ELECTRONIC WARFARE

Established Criteria Not
Met for Airborne
Self-Protection Jammer
Production



92-09053



National Security and
International Affairs Division

B-247311

March 23, 1992

The Honorable David Pryor
Chairman, Subcommittee on Federal Services,
Post Office, and Civil Service
Committee on Governmental Affairs
United States Senate

Dear Mr. Chairman:

On May 11, 1990, the Deputy Secretary of Defense testified before your Subcommittee that the Department of Defense (DOD) would not allow further procurement of the Navy's Airborne Self-Protection Jammer (ASPJ) program if ASPJ did not meet the established reliability growth criterion. As you requested, we evaluated DOD's compliance with this commitment.

Background

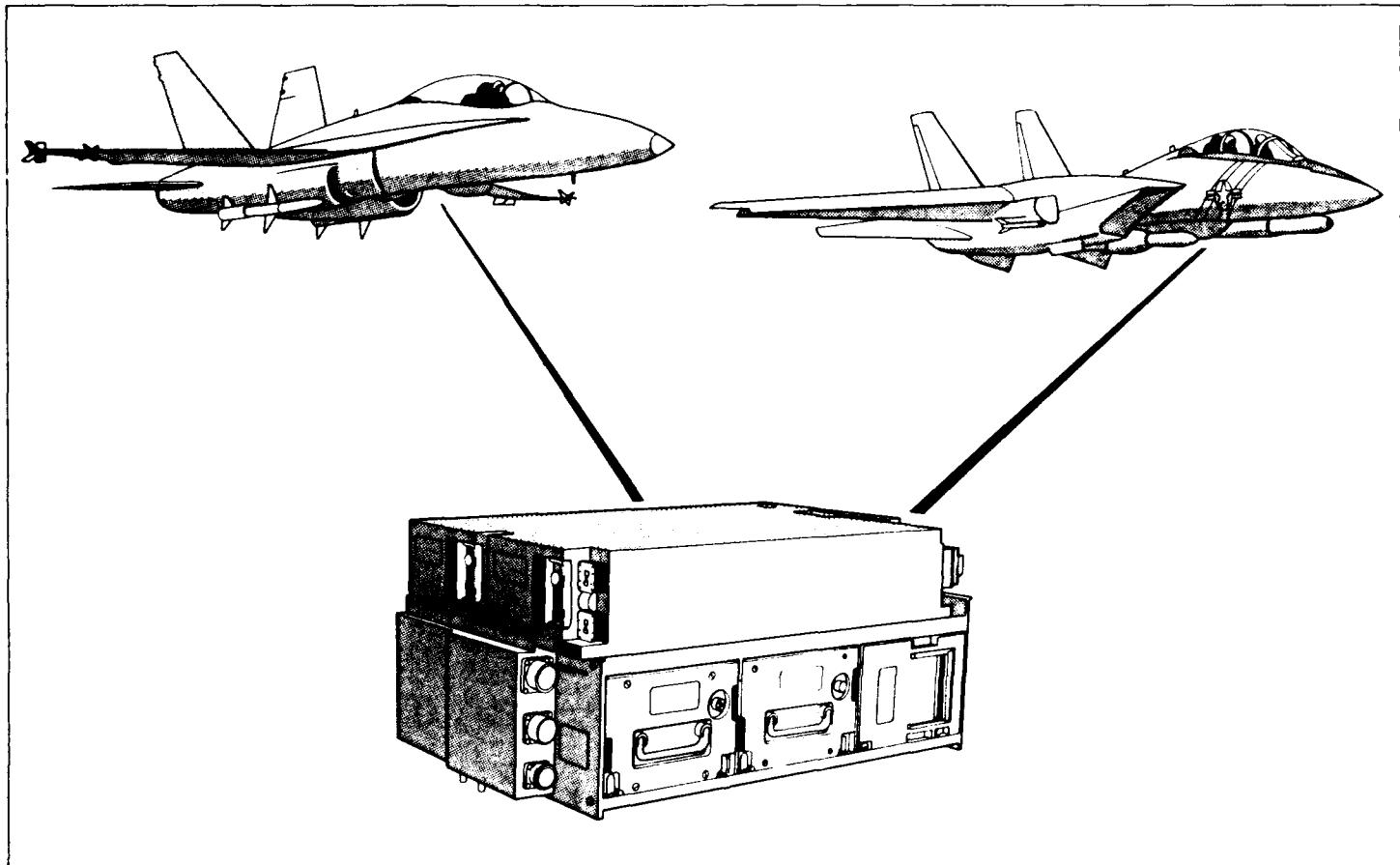
ASPJ is an electronic warfare jammer intended to protect the Navy's F/A-18 and F-14D aircraft from threat weapons. (See fig. 1.) DOD authorized initial production of the jammer in August 1989, despite its marginal performance during operational testing. Subsequently, the decision to initiate ASPJ's Lot I production contract was the subject of hearings before the Subcommittee.

At the hearing, the Deputy Secretary of Defense testified that he had directed the establishment of firm criteria to measure ASPJ's performance and reliability and had directed that the Defense Acquisition Board¹ delay consideration of ASPJ Lot II production until completion of selected reliability growth and other performance tests. The Deputy Secretary also testified that DOD would not allow the program to proceed if ASPJ did not successfully meet the established criteria.

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¹The Defense Acquisition Board is a panel of senior-level DOD officials who oversee major acquisition programs.

Figure 1: ASPJ, F/A-18, and F-14 Aircraft



Source GAO Artist's Rendering

Results in Brief

ASPJ did not meet the criterion established for further production. DOD and the Navy established the criterion for ASPJ's reliability growth, and the Defense Acquisition Board approved the criterion. However, after system failures began to occur during the reliability growth testing, the Navy changed the criterion to exclude system failures attributable to software errors. With the software-induced failures excluded, ASPJ was said to have met the reliability growth criterion; and the Defense Acquisition Board, with knowledge of the change, allowed the program to proceed. If these failures had been included, ASPJ would have failed the test by a large margin. By excluding these system failures, the Navy circumvented DOD's testing standards and failed to recognize the adverse impacts of software problems experienced with other electronic warfare systems similar to

ASPJ. Moreover, additional reliability growth testing conducted after the Defense Acquisition Board allowed the program to proceed shows that ASPJ's software problems are continuing.

Changing Criterion Allowed ASPJ to Pass Reliability Growth Tests

ASPJ's original reliability growth criterion was approved by the Defense Acquisition Board on November 16, 1990. The criterion provided that ASPJ must achieve a specified measure of reliability growth called "mean-time-between-failure-instantaneous"² of at least 75 hours during a minimum of 650 hours of testing. The test plan defined failure to include several types of system malfunctions but did not distinguish between hardware- and software-induced system failures.

ASPJ's reliability growth testing started in August 1990 and was stopped in March 1991. The scored test results identified 17 failures during 729 hours of testing, which resulted in a mean-time-between-failure-instantaneous of 83.75 hours. According to the ASPJ Program Office, ASPJ was thus considered to have passed its reliability growth tests.

Not reflected in the above results, however, were 43 additional failures of ASPJ's built-in test equipment that the Navy attributed to software problems. These failures were excluded because near the end of the test period in March 1991, the Navy revised the test plan to provide that software-induced failures would not be relevant to the scoring of ASPJ's test results. If these failures had been counted, ASPJ's mean-time-between-failure-instantaneous would have been about 9 hours, well below the 75-hour requirement.

Defense Acquisition Board Approved Production Despite Criterion Change

The Defense Acquisition Board approved the ASPJ program for Lot II production after meeting on June 24, 1991. Before approving Lot II production, Defense Acquisition Board officials were provided documentation revealing that software-induced failures had been excluded from the scoring of test results.

The Chairman of the Board advised us that the officials approved Lot II production to avoid a production break. DOD officials also informed us that

²Mean-time-between-failure-instantaneous is computed using a formula that considers total test time and total number of failures and that compensates for progress made in improving reliability during the course of testing. Thus, a system showing rapid reliability improvement during testing would have a higher mean-time-between-failure-instantaneous than one that continued to fail at a constant rate, even if both had the same number of failures during testing.

although excluded from the scoring, the software-induced failures had not been ignored in the decision to approve Lot II production. They said that other tests conducted outside of the reliability growth test program, including developmental flight tests and contractor tests using modified software, had provided reasonable assurance that the software problems had been corrected.

We disagree that DOD officials had reasonable assurance that the software problems had been corrected. First, the developmental flight tests lasted only 45.5 hours instead of the 220 hours required during reliability growth testing to verify the adequacy of software corrections. Moreover, the purpose of the flight tests was not to evaluate software under reliability growth test conditions, but was to evaluate other aspects of ASPJ's performance, such as its capability to correctly identify threats. Similarly, the contractor tests were also of insufficient duration to verify the adequacy of software corrections. Finally, the decision memorandum recording the approval of Lot II production directed the Navy to verify built-in test software performance under actual reliability growth conditions. This indicates that DOD officials lacked assurance that the software problems had been corrected.

The Chairman of the Defense Acquisition Board advised us that he was aware the system was not meeting all its specifications and had designated specific criteria it would have to achieve before granting approval for Lot III production. The Chairman also informed us that the Deputy Secretary of Defense did not participate in the decision to approve ASPJ's Lot II production.

Excluding Software Failures Was Inappropriate

By excluding the 43 built-in test failures attributed to software, the Navy circumvented DOD testing standards. The ASPJ test plan identified Military Standard 2068(AS) as the governing specification for the tests. Military Standard 2068(AS) classifies built-in test equipment failures as relevant failures for scoring and does not authorize the exclusion of software failures from scoring.

In October 1986, Military Standard 781D superseded 2068(AS). Military Standard 781D does not exempt built-in test failures from being counted as relevant in scoring test results. It does exempt software failures if the failures are corrected and the adequacy of the corrections are verified during the reliability growth testing. However, software changes made to

address ASPJ's built-in test failures were not retested during the reliability growth testing preceding the decision to continue production.

ASPJ's Software Problems Continue

ASPJ's reliability growth testing resumed after the approval of Lot II production using the modified software intended to correct the problems revealed during the earlier tests. The additional tests showed that the software problems have not been resolved. Test records show that 21 of the 43 failures that occurred during the first phase of reliability growth testing recurred during the second phase after the Defense Acquisition Board approved Lot II production. The later tests also revealed additional software-induced failures not detected during the first phase.

Software Problems Degrade Electronic Warfare Systems

Our work on other systems, particularly electronic warfare systems similar to ASPJ, has shown that software problems are among the most serious in weapon acquisitions. We have reported to the Congress on a number of occasions how software problems have degraded the performance of electronic warfare systems.

In July 1990, we reported that the improved ALQ-135 jammers produced for the Air Force's F-15 aircraft were placed in storage rather than delivered to tactical units because of software design problems.³ We also reported at that time that the Air Force's ALQ-131 Block II for the F-16 and other aircraft was being used by tactical units in Europe with an inactive receiver/processor because of missing software. The receiver/processor is a major component that is supposed to enhance the jammer's capability.

In February 1987, we testified before the House Committee on Armed Services that as a result of software and other problems, the ALQ-161A defensive avionics system for the B-1B bomber performed poorly and prevented operation of a complete B-1B defensive system.⁴ In early 1991, DOD was still attempting to complete flight testing of software revisions to achieve adequate performance.⁵

³Electronic Warfare: Need to Strengthen Controls Over Air Force Jammer Programs (GAO/NSIAD-90-168, July 11, 1990).

⁴The B-1B Aircraft Program (GAO/T-NSIAD-87-4A, Feb. 25, 1987).

⁵Strategic Bombers: Issues Related to the B-1B Aircraft Program (GAO/T-NSIAD-91-11, Mar. 6, 1991).

Matter for Congressional Consideration

Because of the continued poor performance of the ASPJ, Congress may wish to oppose further production contracts until operational tests, scheduled for completion in fiscal year 1992, have demonstrated that ASPJ will successfully perform its mission.

Scope and Methodology

To accomplish our objective, we examined pertinent testimony given during the congressional hearing, test plans and related approval documents setting out ASPJ's reliability growth criterion, summaries of the results of ASPJ's reliability testing and the related scoring, testing records, and documents pertaining to DOD's decision to continue the system's production. We also examined DOD policy and test standards bearing on the issue and discussed the ASPJ program with DOD officials.

We performed our work at the Offices of the Undersecretary of Defense for Acquisition, Director of Defense Research and Engineering, Director of Operational Test and Evaluation, Assistant Secretary of Defense for Production and Logistics, and the Naval Air Systems Command.

We performed our review from November 1991 to February 1992 in accordance with generally accepted government auditing standards.

As requested, we did not obtain written agency comments on this report. However, we discussed its contents with DOD officials and have incorporated their comments where appropriate.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 10 days from its issue date. At that time, we will send copies to interested congressional committees; the Secretaries of Defense and the Navy; the Director, Office of Management and Budget; and other interested parties. We will make copies available to others upon request.

This report was prepared under the direction of Louis J. Rodrigues, Director, Command, Control, Communications, and Intelligence Issues, who may be reached on (202) 275-4841 if you or your staff have any questions concerning this report. Other major contributors were Jackie B. Guin, Assistant Director; Charles A. Ward, Evaluator-in-Charge; and Peris Cassorla, Evaluator.

Sincerely yours,

Frank C. Conahan

Frank C. Conahan
Assistant Comptroller General